19/5th Sem/UCE505

2021

GEOTECHNICAL ENGINEERING

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer any *five* questions.

1. (a) With the help of phase diagram explain saturated and unsaturated soil state. Determine the relationship between void ratio (e) and porosity(n) of soil.   5+5=10

   (b) State the most suitable laboratory technique to determine permeability of cohesionless soil deposit. Determine the expression for coefficient of permeability(k) for that particular method.   2+8=10

2. (a) "The water holding capacity of a cohesive soil is more than a cohesionless soil". Justify the statement with proper explanation why cohesive soil retains more water.   5

(b) Name the tests which can be used to determine the field density for cohesive and cohesionless soil ? Briefly explain the procedures to determine the relative density of sand in laboratory. 2+8=10

(c) What is quick sand ? Determine the expression for critical hydraulic gradient in case of quick sand condition. 2+3=5

3. (a) State the two methods for determining the liquid limit of soil. Why water content corresponding to 25 numbers of blows is taken as liquid limit in Casagrande Method of testing ? Justify. 5+5=10

(b) If the depth of an isolated footing rests in a clay layer which is sandwiched between two sand layers, how will you ascertain the possibility of any future compression of the clay layer ? Explain in detail. 10

4. (a) For determining the safe bearing capacity of any foundation in soil, what are the important soil parameters which need to be determined in laboratory ? Explain one laboratory test each for a cohesive and cohesionless soil which are used to determine these parameters. 10

(b) The following results were recorded during a cone penetrometer test on a cohesive soil :

Avg. penetration(mm)	15.2	17.3	18.9	21.1	22.8
Avg. water content(%)	33.4	42.6	49.2	59.4	66.8

Determine :

   (i) Liquid limit of the soil.

  (ii) If the plastic limit of the soil was found to be 33%, determine its plasticity index and classify the soil.   10

5. (a) During a test using a constant head permeameter, the following data were collected. Determine the average value of k.

Diameter of sample=100mm

Temperature=17 °C

Distance between manometer tapping points = 150mm.   10

Quantity collected in 2 mins(ml)	541	503	509	474
Difference in manometer levels(mm)	76	72	68	65

(b) With suitable graphs, explain the stress-strain and volume change behaviour of cohesionless soil. 10

6. (a) An earth embankment is to be compacted to a dry unit weight of 1.84g/cc at a placement water content of 15%. The in-situ dry density and water content in the borrow pit are 1.77g/cc and 8% respectively. How much excavation should be carried out in the borrow pit for each cum of embankment ? 10

(b) State the advantages and disadvantages of the following test : 5+5=10

(i) Direct Shear test

(ii) Unconfined Compression test.